VACCINATION FOR SMALLPOX—THE THREE-POINT CHISEL METHOD*

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DISCUSSION *by J. C. Geiger, M. D., San Francisco; John J. Sippy, M. D., Stockton; Alex M. Lesem, M. D., San Diego.*

IN August, 1911, Dr. John Force began vaccinating the entering students of the University of California at Berkeley with a dental scaling chisel held perpendicularly to the skin, denuding the epiderm by rotation of the chisel. In this manner three circles of epidermis, two millimeters in diameter, were removed, glycerinized vaccine was then applied to the three denuded surfaces and rubbed gently in. The resultant vesicles were remarkably uniform.

In a series of 111 "takes," measured on the seventh day after the vaccination, the mean diameter was 7.6 millimeters, and the standard deviation was 0.7 millimeters, whereas in a series of 133 vaccinated by the multiple pressure method, the mean vesicle measured 9.3 millimeters, with a standard deviation of 1.4 millimeters. The scars resulting from the chisel method were uniformly circular and approximated 10 millimeters in diameter.

Doctor Force demonstrated this vaccination method to Dr. Frank Kelly and to Dr. A. F. Gillihan, and they used it in their work with the State Board of Health. Dr. Gavin Telfer of the State Board of Health also became familiar with the procedure and recommended it to Dr. William Jeter of our vaccination room as a great improvement over our single-puncture method, then in use.

Doctor Jeter started to use this triple method in the year 1924 and soon became very enthusiastic as to its advantages, claiming that the reactions obtained were far less severe and that the average length of time for healing was cut in two; for on an average only three weeks for healing was required where formerly, by the one-puncture method, the average had been six weeks.

He also found that he could discard his stick of lunar caustic, as by the new method no proud flesh or slough formed after the reaction.

When he told me about the results, I did not believe such an improvement in method could be possible, so I spent a month in the vaccination room to observe, finally becoming convinced of the great advantages of the three-point chisel method.

TECHNIQUE

Vaccination is to be looked upon as a surgical procedure and carried out with all the precautions necessary for the prevention of septic infections. Especially must the physician carefully consider the cleanliness of his person, his hands, the instruments, and the place of operation. Aseptic surgical technique in all that the words imply must be the rule.

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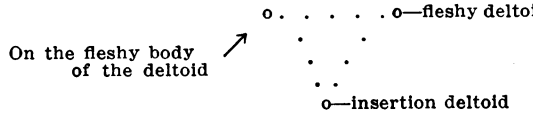
THE SET-UP

Rotary chisel (2½ millimeters, Cutter Laboratory, Berkeley).
Sealed capillary vaccine tubes just out of the refrigerator.
Rubber bulbs for same.
Sterile gauze squares for dressings.
Absorbent cotton.
Acetone for washing arms.
Burning alcohol.
Alcohol lamp.
Zinc oxid rubber tape.
Scissors.
Sterile gown.

The blade of the rotary chisel (2½ millimeters) is dipped in 98 per cent alcohol and immediately flamed in flame of alcohol lamp before use on each different person. It may be laid over flat tape spool to cool, blade extended over the edge. The insertion of the deltoid muscle a little to the outer side of the upper arm is selected for the first puncture. The skin is made tense by grasping the inner side of the arm with the left hand, and just enough pressure and twisting (rotary) motion of the chisel is exerted to remove the epiderm. It is important that the abrasion be not too deep, and skidding of the chisel should be avoided. The drawing of blood is also to be avoided, as it may float away the lymph and prevent absorption. Deep scarification is more likely to be followed by an excessive inflammatory reaction.[1]

It is not desirable to abrade deeper than is necessary to see the little reddish points which represents the loops of the capillary blood vessels.[1] The other two denudations are made in the same manner and with the same care above the insertion of the deltoid.



Denudations should never be less than one inch (2½ to 3 centimeters) apart and preferably an inch and a half apart (3½ to 4 centimeters).

The ends of the sealed capillary glass tubes are then broken off (aseptically) and by pressure on the bulb the vaccine is deposited in equal amounts on the three denuded surfaces. With the cooled flat side of the chisel held horizontally, the virus is rubbed gently and carefully into the denuded surfaces. It is our custom to immediately cover the lesions with a loosely fitting square pad of several layers of sterile gauze; a couple of quarter-inch zinc oxid adhesive tapes are applied loosely, but the ends of these should never come together around the underside of the arm. Celluloid shields or other types of dressings are never used. All peripheral pressure or suction is to be avoided.

The chisel with a 2½ millimeter edge is a little safer to use than the one with a 2 millimeter edge. There is a great difference in different persons as to thickness of epiderm, so sharpness of chisel, the amount of pressure, length of rotation, are factors for personal judgment of the physician.

Care must be taken that the chisel blade is not overheated when the vaccine is rubbed in, as

otherwise the vaccine will be killed and will not take. On this account some prefer to use a sterile toothpick, or use two blades and alternate their use.

"Some writers have advocated vaccination by hypodermic or, rather, intradermal puncture. The alleged advantage that little or no scar results is, in reality, a disadvantage, for the presence of the scar and its character constitute, as a rule, visible evidence of the amount of protection against smallpox." [1]

"It is chiefly on account of the great diagnostic value of the vesicle and scar that subcutaneous methods of vaccination are not to be commended." [2]

Again, to quote Osler: "The best indices of the efficacy of vaccination are the course of the vesicle, the general symptoms, and the scar. Ultimately we may learn more exact guides to the immunizing power of vaccine, but at present we can only say that if the vesicle and scar are characteristic, there is more or less immunity."

"Small insertions are insisted upon because the diameter of the lesion (and the depth of the take [4]) is dependent upon the area of the insertion, and the rapidity of the healing is dependent upon the size (and depth [4]) of the lesion." [3]

POINTS IN FAVOR OF THE THREE-POINT CHISEL DENUDATIONS (TRIANGLE FORM)

1. Chances of a take are increased threefold: of great advantage in health department work, both in contacts where every minute counts in getting protection, and also in those instances where it is almost impossible to get people to return in case of failure of take.

2. Local reactions are less severe, as the load is distributed to three areas instead of one.

3. Rotundity of vesicle and of scar tissue are insured; the vesicle, not breaking so easily, does not stick to a gauze dressing so readily.

4. The pitted scar area left conforms to the recommendations of the Local Government Board of England.[2]

5. Reactions of immunity are just as easily read.

6. If the three insertions all take, the surface area of the takes and the depth takes are each only one-third as great as a one-point insertion.

7. No sloughing, no caustic.

8. The danger of secondary infection greatly reduced.

9. Scabs come off on an average in three weeks instead of six weeks.

10. Dressings and after-care are reduced one-half.

11. A reduction of at least two-thirds in the number of cases where axillary lymph glands become involved. A glance at your "Gray's Anatomy," to the picture showing the distribution of the lymphatics of the arm and axillary region, will show you why the load is split up and not all put on one lymph drain.

12. Particularly adapted to health department work on account of its simplicity, rapidity of operation, ease of aseptic surgical technique; assured protection against smallpox; and beautiful scars (not unsightly) characteristically pitted enough to be read for at least a period of seven years after the take.

REVACCINATION

Revaccination of those who have an old pitted scar should be done every seven years. Fifty per cent or more of these will show an immunity reaction. It is not as essential to use the three-point method, as takes practically never react as strongly in those who have had a former take. A good plan, however, is to use the triangle method as usual, using two points of denudation for control observations and one denudation for the insertion of the vaccine. In this way very accurate data can be obtained on immunity.

AFTER-CARE

Vaccination must be treated as a surgical condition from start to finish, and only when the reaction and its effects are entirely over and the skin returns to normal should care be relaxed. Secondary infection under proper technique and after-care is very rare. When it does occur, it is treated symptomatically, as surgical procedure demands.

All primary vaccinations in persons who have not recently contacted smallpox should be observed at the end of ten and fifteen days.

Revaccinations should be observed in two and four days in order to detect a possible reaction of immunity. The vaccination should be considered successful as soon as this reaction of immunity appears and begins to subside.

If no reaction of immunity appears, and if later on no vesicle appears, the vaccine has lost its potency and is at fault.

CARE OF VACCINE

Smallpox vaccine cannot be kept too cold and it must be a constant cold. It deteriorates in the ordinary icebox, and should preferably be kept in the ice-making compartment of the refrigerating machine. If a mechanical refrigeration is not available, and it has to be kept in an ordinary icebox, keep it on the ice in a metal or glass container, and not merely on a shelf. For use in the field, pack in ice, or in vacuum bottles containing shaved ice.[3]

Vaccine must be kept cold from time of manufacture until used. Never expose to body warmth or to sunlight. Even sunlight hitting the arm while vaccinating may kill its potency.

A test for full potency is that vaccine should give 50 per cent of vaccinoid reactions in the group of persons vaccinated successfully more than ten years previously.[3]

COMMENT

"The three-insertion triangle" method of vaccination has been in constant and very nearly exclusive use in the Los Angeles City Health Department since 1924. We estimate that 75,000 vaccinations have thus been performed with far less effort, work, and worry, with a halving of

after-care and dressings, at considerably less expense than from other methods by a technique that seems in every way to fill the requirements of Public Health work. The only objection set forth by the uninitiated seeking vaccination has been the fear of producing large unsightly scars. The uniformly rotund, slightly pitted scars obtained in almost every instance has now gone far to quiet such fears.

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REFERENCES

1. Schamberg, Frank J. Nelson Loose Leaf Medicine.

2. Dock, George: Osler's Modern Medicine, 1907 edition.

3. Leake, James P., and Force, John M.: The Essentials of Smallpox Vaccination, Public Health Reports, Vol. 45, No. 46, p. 2793. Issued November 14, 1930. (This article is a revision of reprint 686, United States Treasury Department, Public Health Service.)

4. Observation by G. M. S.

DISCUSSION

J. C. Geiger, M. D. (Director of Public Health, San Francisco).—There is little to be added to Doctor Stevens' presentation of the procedures and advantages of the three-point chisel method of vaccination against smallpox, as developed by Doctor Force of the University of California and practiced rather extensively at the present time. The method is excellent, and has definite advantages over certain other methods, as Doctor Stevens has pointed out.

Another method which might very well be mentioned is that popularly known as the multiple point pressure method, as recommended by the United States Public Health Service. The results of this method, in which there are made, in a small area (of 5 to 7 millimeters in diameter), with a tangentially held sterile needle, a number of punctate abrasions in the upper layers of the epidermis, are likewise highly satisfactory. Indeed, many of the advantages of one method may be credited also to the other.

However, my only purpose in mentioning this other method, and the only comment I have to make on Doctor Stevens' paper, lies in the emphasis that should be made on progressive methods. Vaccination against smallpox has been known and practiced for many years. It is true that we see the large deeply pitted scar less frequently now than we did formerly, but there still occur instances in which this simple procedure, which should cause but a minimum amount of inconvenience and heal without complication, progresses to secondarily infected ulceration, lymphangitis, etc. If the method of vaccination were intelligently carried out in all instances, as it should be, in keeping with the viewpoint that the procedure is really surgical, even with a minimum of follow-up, these complications can be avoided. Doctor Stevens' paper definitely states that the Los Angeles Department of Public Health has accomplished this goal during the period of time that the three-point chisel method has been used.

Progress includes improvement in procedures and methods. We must take cognizance of these, even in those long-established and too frequently taken-for-granted activities in public health, as well as medical and surgical practice.

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John J. Sippy, M. D. (District Health Officer, Stockton).—I commend Doctor Stevens for his description of a procedure which, while perhaps not so apt to engage attention as a rare surgical operation, is of more practical value to the everyday practitioner, and which if followed will induce more persons to accept the benefits of preventive medicine.

In our work in San Joaquin County, we have used the chisel method exclusively. One of the greatest deterrents to universal acceptance of vaccination is dread of unsightly scars. For this reason we use only one scarification instead of three, except in case of smallpox contacts in whom, because of insufficient time for revaccination, we wish to insure a "take." Our experience with both mild and virulent smallpox indicates that immunity conferred by the one-point inoculation is as efficacious as the three-point method.

In girls the site selected for vaccination is the supraspinous scapular area, so that the resultant scar may be hidden under the shoulder straps of dresses. Rarely, with the chisel method, is the scar at all objectionable. Unfortunately, I know of no way to predict the occurrence of keloids, and we have had a few to result. In young children of both sexes, who may scratch the vesicle and thus produce multiple vaccinia, the shoulder site has an advantage of inaccessibility. It is freer from muscle play and clothing friction and, despite possibility of rupturing the vesicle while asleep, this occurs infrequently. We refuse to do leg vaccinations, and I should be interested to hear Doctor Stevens' comment on this latter procedure.

We use bulk vaccine, applied with sterile toothpicks. Careful technique prevents contamination, and we believe our percentage of "takes," which in ordinary routine reaches 98 to 99 per cent, is higher than with the capillary tubes of glycerinated virus.

By way of after-care, we apply no dressings. In a number of instances where patients applied adhesive tape, the irritation and thinning of epidermis produced by the tape has led to widened vesicles or multiple takes and objectionable length of time in healing. Patients with rough or soiled clothing are advised to pin a few layers of clean gauze to the clothing so as to protect the vesicle.

In a series of 38,000 vaccinations we have had no infection, cellulitis, or lymphangitis attributable to this lack of dressing, and it seems to shorten the time of healing. If unusual itching or edema occurs, we advise alcohol to bathe the area around the vesicle or the application of a thin layer of gauze in which an opening is made for the vesicle, and kept moist with alcohol.

Patients are advised to be revaccinated every five years. In no case where this advice is followed have we secured a vesicle, but only an immune reaction. Revaccinations of service men almost all result in immune reactions or rarely in a vaccinoid papule, but not a true vesicle. This would indicate that immunity obtained from a successful vaccination in the vast majority of persons lasts for many more years than five or seven. In fact, although I advise revaccination, I never worry about the occurrence of smallpox in a contact of mild or alastrim type of the disease if he has been successfully vaccinated within his lifetime.

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Alex M. Lesem, M. D. (739 Fourth Avenue, San Diego).—During the year 1924 there occurred in the city of San Diego 426 cases of smallpox. Since 1924 more than 50,000 persons in San Diego County have been vaccinated by the Health Department against smallpox. The technique used in the work is essentially the same as that outlined by Doctor Stevens, with some slight changes which were deemed advisable in order to speed up the work, since large groups of children were being vaccinated in the schools.

The three-point method was used by this department for three years, but upon request of the parents who objected, particularly in the case of little girls, that the three scars were unsightly, the Health Department discontinued the use of three separate scarifications, and at the present time is using only one. Individual sealed capillary glass tubes are used instead of the bulk vaccine, for the reason that there is more danger of contaminating the bulk vaccine.

The vaccine is first deposited on the arm and then the scarification is made for the reason that it is easier to see the drop of vaccine than it is to see the scarification, particularly when the operator is working in a poorly lighted room.

It is deemed advisable in the vaccination of school children who are very active on the playground to cover the vaccination with sterile gauze, square, securely fastened with adhesive, with particular care being taken not to encircle the arm. The method used by this department is very rapid. School children are brought to the vaccination table and kept in line; the arm is scrubbed with ether by a nurse; the child is vaccinated by a physician; and the bandage is placed on the arm by the second nurse. Between four and five hundred children may be vaccinated in a forenoon by one physician, with the minimum disruption of class routine.

Out of more than 50,000 vaccinations in which this method was employed, only one case had a severe secondary infection, but with complete recovery and no ill effects.

In conclusion, I wish to state that I prefer the scarification method for group work in preference to all other types of vaccination, and that the single scarification does not produce a scar different from multiple scarification.

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DOCTOR STEVENS (Closing).—A good method that meets the need of the private doctor may not be best suited for the use of a health department in a large city where epidemic and endemic smallpox have to be combated by a rather large number of different vaccinators. Here it is imperative to get immediate takes with safety. Here, too, a uniform method is highly desirable. The only objection is the number of scars. If carefully done, these will not be unsightly. I have had no experience in inserting the vaccine in the scapulary supraspinous region as advocated by Doctor Sippy, but do not see the contraindications that are so apparent when vaccinations are applied to the legs.

FRACTURES OF THE SPINE*

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DISCUSSION *by Rodney F. Atsatt, M. D., Santa Barbara; John C. Wilson, M. D., Los Angeles.*

AT the Lane Library lately, for the purposes of this paper, I looked over the literature for the past ten years dealing with fractures of the spine, uncomplicated by cord injuries. From these reports in English, French and German, and covering well over a thousand fractured spines, it is apparent that such fractures are common injuries; that fully half of them are simple compression fractures; that, except where an x-ray, and notably a lateral x-ray, is employed, they are all too frequently not recognized at the time of injury; that they constitute a heavy burden upon insurance carriers, and therefore, ultimately, upon industry; that if unrecognized, or inadequately treated, they may result in serious impairment of function; that this loss of function is usually not the result of injury to the vertebral body, but is the result of distorted bodily mechanics, *i. e.*, of bad posture and of involuntary efforts at correcting that posture. And this bad posture is the result of change in the mutual relations of the planes of the upper and lower surfaces of the bodies of the injured vertebrae.

In the time at my disposal I cannot possibly cover all types of spinal injury, so I shall confine my remarks to those which compose the majority, actually some 80 per cent, of such fractures.

INCIDENCE

A large majority of such fractures occur in adult males, although since the advent of the automobile, women are increasingly acquiring their quota, at present about 15 per cent. Of these simple compression fractures it is estimated that nearly 80 per cent occur between the eleventh dorsal and second lumbar vertebrae, inclusive; and of these nearly half involve the first lumbar vertebra. These 80 per cent, then, are the subject of this paper.

COMPLICATIONS

These are neurologic symptoms, and fractures of laminae of articular processes of the pedicles and spinous and transverse processes. Aside from the neurologic conditions, fractures of the articular processes are the most troublesome. Finally, injuries elsewhere, notably of the os calcis, may occur; and, in the presence of the graver injury, may be overlooked.

CAUSATION

Any condition or situation which will cause a hyperflexion of the spine, such as blows—actually thrusts—from above and behind, and falls in which the individual lands standing or sitting. Even sudden muscular contractions would appear to be capable of producing compression fractures. Doctor Wesson, who is with us today, sustained such a fracture.

Mechanism.—Crushing of the spongiosa of the anterior portion of the body of one or more vertebrae. I shall not touch on complicating dislocation, though they are probably the result of a diagonal thrust rather than of a simple downward and forward crush.

SYMPTOMS

In an admirable paper by Osgood, one of the many which I consulted in preparing this address, these are divided into early and late symptoms.

Early Symptoms.—At first, these may be masked by those of other fractures or by shock. In a medico-legal case in which I figured lately, with multiple fractures of the extremities, two compressions of the vertebrae were not discovered until nearly a year after the accident. Again, they may be so slight as to escape notice. Of these early symptoms, muscle spasm, with localized limitation of back motion, is *always* present. Tenderness to direct pressure over the spinous processes of the injured vertebrae is *almost* always present. Pain, definitely localized, may be present, but is sometimes absent. In all the cases that I have seen, there has invariably been a fairly localized feeling of weakness, however, even when actual pain was absent. Finally, very frequently marked distention of the abdomen may be a distressing symptom.[1]

* Read at the twenty-ninth annual meeting of the Nevada State Medical Association, Reno, Nevada, September 23-24, 1932.

1 In the discussion elicited by this paper, Doctor Holcomb of Oakland directed attention to this very distressing abdominal distension which frequently accompanies spinal fractures, which I had included in my notes but failed to mention.